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Research Article

Streamlining the Building Permit Process with Modular Integrated Construction (MiC): A SWOT Analysis from Hong Kong

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Abstract

The construction industry faces increasing demands for efficiency, sustainability, and regulatory compliance. Modular Integrated Construction (MiC) has emerged as a potential solution to accelerate building processes, improve quality control, and address labor shortages. However, its impact on the regulatory framework, particularly the building permit process, remains underexplored. This study investigates whether MiC can contribute to streamlining building permit approvals, using Hong Kong as a case study. We adopt a qualitative research approach, conducting expert interviews with key stakeholders in the Hong Kong construction and planning sectors. Through a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis, we classify and assess the benefits, challenges, and potential reforms associated with MiC in the permit approval process. Key findings suggest that MiC's prefabrication and standardization can facilitate faster regulatory approvals, particularly through initiatives such as "type permits" or pre-approved component libraries within building authorities. However, challenges persist, including regulatory misalignment, limited local expertise, and the need for clearer guidelines on integrating MiC within existing urban development policies. Comparative reflections on other regulatory systems suggest that MiC's potential benefits extend beyond Hong Kong, provided that regulatory frameworks adapt to accommodate its unique characteristics. Finally, we discuss limitations and propose future research directions, including cross-jurisdictional comparisons and further case studies on MiC's regulatory integration. Our findings contribute to the growing discourse on construction innovation and regulatory adaptation, offering insights for both policymakers and industry practitioners seeking to enhance efficiency in urban development through MiC.

Keywords: Modular Integrated Construction; Building permit; SWOT analysis; Construction

Highlights

- Streamlining the building permit process with modular integrated construction (MiC).
- SWOT analysis reveals challenges and opportunities on the building permit process in Hong Kong.
- Insights for both policymakers and industry practitioners.

1 Introduction

Across the globe, the construction industry is under growing pressure to deliver projects more quickly, sustainably, and cost-effectively—while still complying with increasingly complex regulatory frameworks. Modular Integrated Construction (MiC), which entails the offsite fabrication and onsite assembly of standardized building modules, has gained attention as a means to meet these demands. MiC offers significant potential to improve construction quality, reduce on-site labor requirements, and accelerate timelines. Yet, despite its technical promise, its integration into established regulatory systems—particularly building permit procedures—remains a pressing challenge. While much effort on research has been put into automated code compliance checking to improve the building permit checks (Amor, R., & Dimyadi,2021), the actual constructions

Building permits serve as a critical regulatory checkpoint to ensure that developments meet safety, planning, and legal standards (Fauth et al., 2024a). However, existing permitting procedures are often designed around conventional, cast-in-situ construction methods (Lee et al., 2016). As a result, they may not readily accommodate the standardized and repetitive nature of MiC. These procedural misalignments can delay project approvals and undercut many of MiC's potential efficiencies.

Hong Kong represents a particularly relevant case study for exploring these dynamics. As one of the world's most densely populated cities, it has both an urgent need for efficient housing delivery and a strong governmental interest in construction innovation. Recent policy initiatives, such as the 10% Gross Floor Area (GFA) concession for MiC projects (Construction Industry Council) and the development of In-Principle Approval (IPA) mechanisms, illustrate efforts to modernize the permitting system. Still, implementation hurdles remain, including interdepartmental coordination, limited regulatory expertise in MiC, and inconsistencies in the treatment of prefabricated modules.

This study investigates whether and how MiC can contribute to streamlining the building permit process in Hong Kong. To do so, it applies a SWOT (Strengths, Weaknesses, Opportunities, and Threats) framework as both an analytical lens and a structuring device. SWOT analysis enables a systematic examination of the internal and external factors (Mintzberg,1994) shaping the regulatory integration of MiC. Strengths and weaknesses highlight intrinsic characteristics of Hong Kong's current permit system and MiC's technical setup, while opportunities and threats emphasize future developments and systemic risks, such as digitalization, supply chain dependencies, and policy evolution.

The research is grounded in a qualitative study involving expert interviews with key actors from Hong Kong's regulatory bodies, project development authorities, and infrastructure service departments. Their insights provide a nuanced view of the real-world implications of aligning MiC with permitting systems. The findings are not only relevant for Hong Kong but offer transferrable lessons for other jurisdictions seeking to modernize their regulatory regimes in response to emerging construction technologies.

This study aims to explore the intersection of MiC and building permit processes, with a focus on whether MiC can contribute to streamlining permit approvals in Hong Kong. The central research question guiding this study is:

- Can MiC contribute to streamlining the building permit process? What are the existing strengths, weaknesses, opportunities, and threats?

Understanding the potential of MiC to expedite permit approvals is crucial for policymakers, construction professionals, and regulatory bodies seeking to enhance urban development efficiency. By examining the experiences and insights of experts involved in both MiC projects and building permitting, this research seeks to identify opportunities for aligning regulatory frameworks with innovative construction practices.

2 Background

2.1 Modular Integrated Construction

MiC, as a disruptive and transformative innovation, is garnering significant attention from industry stakeholders and researchers (Zhang & Pan, 2021). MiC refers to an innovative construction approach that involves manufacturing three-dimensional volumetric building modules under controlled offsite or offshore factories, which are then transported and installed on-site to form complete buildings (Pan et al., 2020). Completed projects have highlighted various advantages of MiC, including shorter project timelines (Wuni & Shen, 2020), lower labor expenses (Zhang & Pan, 2021), enhanced worker safety and health conditions (Chatzimichailidou & Ma, 2022), and reduced construction waste generation (Laovisutthichai et al., 2022). Thus, MiC has gained traction as a solution to address challenges such as labor shortages, rising construction costs, and the need for faster delivery of high-quality buildings (Wu et al., 2022). For example, in Hong Kong, where dense urban environments and stringent building regulations pose unique challenges, MiC has emerged as a promising alternative to traditional cast-in-situ construction methods (Wu et al., 2022).

2.2 Building Permit Processes with a Particular Focus on Hong Kong

A building permit is an official approval issued by a regulatory authority that allows the construction, alteration, or demolition of a structure to proceed in compliance with local building codes and regulations. Building permits ensure that construction projects meet safety, health, and environmental standards, protecting both occupants and the broader community (Noardo et al., 2020).

In many jurisdictions, the permitting process involves multiple steps, including plan submission, design review, inspections, and final approval. The complexity and duration of this process can vary significantly depending on the project's size, location, and regulatory environment (Fauth et al., 2024b). Delays in permitting can lead to increased costs and project uncertainties, prompting efforts to streamline and modernize the process (Fauth et al., 2024c)

The Hong Kong Buildings Department introduced the IPA or Pre-Acceptance process specifically to facilitate the use of MiC. This process enables developers and manufacturers to obtain advance approval for the design and construction details of modular units before submitting a formal building plan application (Buildings Department, 2025). As part of the IPA process, developers submit technical specifications related to the structural design, fire safety, and connection interfaces of the modular units. These standard modular designs are then reviewed by the Buildings Department, and if found compliant, they receive pre-approval. Once a module has been pre-approved, it can be reused across multiple projects without requiring a full technical review each time. Only site-specific aspects such as foundation works, transportation, on-site installation, and the connections between the modules remain subject to individual assessment for each specific project. This pre-approval system aims to accelerate the building permit process by reducing redundancy in regulatory checks while maintaining safety and quality standards.

A notable example of regulatory specialty is the ‘Typenbaugenehmigung’ in Germany (Musterbauordnung, 2025). This concept refers to a type of approval system in which standardized building designs are pre-approved for compliance with building codes. Once a design receives type approval, it can be reused for multiple projects without requiring a full permit review each time but is rarely used in Germany. This approach significantly reduces approval times for repetitive construction projects, particularly in sectors like social housing and modular construction. The Typenbaugenehmigung [type permit] system offers valuable lessons for integrating MiC into building permit processes by emphasizing standardization and pre-approval mechanisms.

3 Methodology

3.1 Research Design

This study employs a qualitative research approach to investigate the potential impact of MiC on the building permit process in Hong Kong. Given the limited prior research on this topic and the need to capture in-depth insights from practitioners, expert interviews were selected as the primary data collection method.

3.2 Data Collection

Semi-structured interviews were conducted with 8 professionals representing key stakeholders involved in the building permitting process and MiC in Hong Kong. The interviewees included regulatory officials from the governmental and private parties involved in the building permit process. Interviews were conducted in December 2024. Each interview lasted approximately 30 to 60 minutes and was recorded with consent, followed by verbatim transcription.

The interview guideline was designed based on a review of relevant literature on construction permitting and offsite construction methods. It included open-ended questions focusing on the following themes:

- Perceived advantages and challenges of MiC in the context of building permits.
- Experiences with pre-approval schemes for modular units.
- Opportunities for streamlining approvals using MiC.

3.3 Expert Criteria and Profile

Experts were selected based on their professional experience and active involvement in MiC projects or the building permit process in Hong Kong. The following criteria were used to identify suitable interviewees. Table 1 below provides an overview of the interviewed experts:

- Minimum of 5 years of experience in the construction and real estate industry.
- Direct involvement in permitting processes, or regulatory oversight.

Table 1: Overview of the interviewed experts.

Interview ID	Number of Interviewees	Organisation	Sector	Years of Experience	Area of Expertise
HK1	2	Independent Checking Unit, Housing Department	Public Sector	30+	Building control, public housing, modular design compliance
HK2	1	Buildings Department	Public Sector	30+	Centralised processing, electronic permit systems, interdepartmental coordination
HK3	4	Electrical and Mechanical Services Department (EMSD)	Public Sector	Not specified (senior leadership roles)	BIM, asset management, digital twins, regulatory oversight for E&M systems
HK5	1	University Estates Office	Quasi-Governmental / Educational	25+	Planning applications, building permits, client-side project development

3.4 Expert Criteria and Profile

A qualitative content analysis approach was applied to analyze the interview transcripts. The analysis was guided by the principles of systematic coding as described by Gläser and Laudel (2010). The following steps were undertaken:

1. Transcripts were read multiple times to ensure familiarization with the data.
2. Initial codes were assigned to text segments reflecting key concepts and themes.
3. Codes were grouped into broader categories aligned with the Strengths, Weaknesses, Opportunities, and Threats (SWOT) framework.
4. The emergent themes were reviewed and refined in consultation with two other researchers to ensure reliability.

3.5 Expert Criteria and Profile

The SWOT analysis served as a structuring tool to synthesize the coded data into a results-oriented framework (Benzaghta et al., 2021). Strengths and weaknesses represent internal factors related to the characteristics of MiC and the Hong Kong permitting system. Opportunities and threats reflect external influences such as policy developments, supply chain dependencies, and technological trends.

3.6 Ethical Considerations

Participation was voluntary, and interviewees were assured of anonymity and confidentiality. All data were anonymized prior to analysis, and personal identifiers were removed from transcripts.

4 Results- SWOT Analysis

Based on qualitative expert interviews with key stakeholders in the Hong Kong construction and regulatory sectors, a SWOT analysis was conducted to classify the benefits, challenges, and potential impacts of Modular Integrated Construction (MiC) on the building permit process. The analysis is structured into four categories: strengths, weaknesses, opportunities, and threats.

Strengths

1. Standardization and Design Consistency: MiC facilitates the standardization of building components and modular units, leading to greater uniformity in design. Public housing authorities in Hong Kong have successfully applied standardized modular designs, reducing plan-checking complexity and accelerating approvals (HK1).
2. Pre-Approval Mechanisms: The Hong Kong Buildings Department offers an IPA process for MiC units. Once a module's structural, fire safety, and connection details are pre-approved, subsequent permit applications can proceed more smoothly and swiftly (HK5).
3. Time Savings in Approval: The pre-approval system allows permit officers to focus on assessing site-specific aspects rather than reevaluating individual modules, streamlining the review process (HK1, HK2, HK5).

Weaknesses

1. Interface Challenges: While modular units may be pre-approved, site-specific concerns such as structural stability, connections, and fire safety still require individual evaluation, preventing full automation of approvals (HK2, HK5).
2. Limited Expertise: Regulatory bodies and industry practitioners are still adapting to MiC processes. Capacity-building efforts are needed to ensure consistent evaluations and to maximize the benefits of pre-approval mechanisms (HK3).
3. Less aesthetical stimulation: Simple and repetitive designs in the context of urban planning (HK1).

Opportunities

1. Expansion of Type Permits: Building on pre-approval practices, the development of a comprehensive module library or IPA system could further reduce approval timelines. Standardized solutions could allow for near-automatic approvals for frequently used designs (HK1).
2. Digitalization: Planned future integration of Building Information Modeling (BIM) in the submission process (targeted for 2026) could synchronize MiC design verification with regulatory assessments, enhancing efficiency and accuracy (HK5).
3. Cross-Sector Collaboration: Enhanced cooperation between regulatory bodies, housing authorities, and private developers could lead to adaptive regulatory frameworks that better accommodate offsite construction methods (HK1, HK3).
4. Standardization of Building Services: The development of pre-approved MiMEP (Multi-trade Integrated Mechanical, Electrical, and Plumbing Systems) solutions could further align with MiC's pre-approval processes, creating type-approved MEP modules similar to pre-approved structural modules (HK3).
5. Policy Incentives: Hong Kong authorities offer a 10% Gross Floor Area (GFA) concession for buildings adopting MiC, encouraging uptake and aligning regulatory incentives with modular construction adoption (HK1).

Threats

1. Fragmented Approval Pathways: Despite pre-approval mechanisms, the need for alignment between multiple departments (e.g., Buildings Department, Planning Department, Lands Department) can introduce delays and inconsistencies in the permit process (HK2). Also, this alternate path means a challenge for the electronic submission hub for the permits which is currently under implementation (HK2).
2. Over-Reliance on Specific Suppliers: The dependence on offshore module manufacturing, particularly in mainland China, poses supply chain risks and potential bottlenecks, which could undermine the promised time savings (HK5).
3. Resistance to Change: While incentives exist, traditional construction practices and conservative regulatory mindsets may hinder the widespread adoption of MiC and pre-approval pathways (HK3).
4. Regulatory Adaptation Lag: MiC's introduction in Hong Kong preceded the establishment of tailored regulations, leading to early-stage uncertainties and additional scrutiny for offshore-manufactured modules (HK5).

5 Discussion

The findings highlight the potential for MiC to streamline building permit processes through pre-approval mechanisms and standardized designs. However, implementing a similar system in other countries may present challenges. For instance, regions with diverse climatic conditions and insulation requirements may struggle to standardize modular units. The same modular design approved in Hong Kong might not be suitable for colder climates in Scandinavia, requiring climate-specific adaptations that complicate standardization efforts. That might be the reason why the Type permit in Germany is less used.

Furthermore, the density and the limited space of the city of Hong Kong require particular considerations when it comes to construction sites. Also, Hong Kong has a pressing need to deliver housing and affordable housing in short time. Further, the location of Hong Kong benefits from cheaper suppliers outside the city. All these aspects incentive the use of MiC in Hong Kong even more.

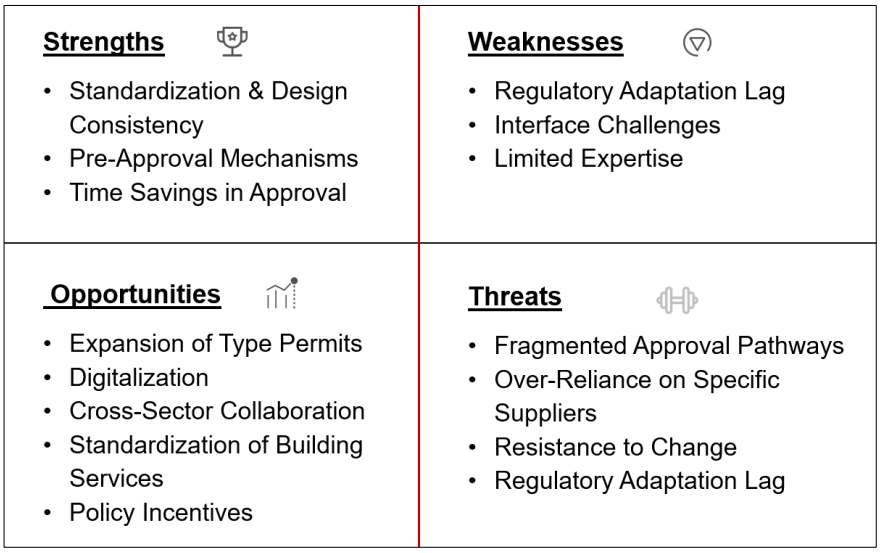

Figure 1: Key findings of the SWOT analysis.

Beyond the immediate regulatory implications, the findings invite broader reflection on the institutional, social, and environmental dimensions of streamlining permit processes through MiC. One critical aspect is the capacity of regulatory institutions to adapt through structured learning and inter-agency coordination. The successful implementation of pre-approval systems such as IPA depends not only on technical standardization but also on continuous institutional learning and the development of shared regulatory knowledge. Embedding feedback loops—such as post-occupancy evaluations or systematic reviews of pre-approved components—could enhance long-term regulatory responsiveness and support evidence-based policy refinement. Additionally, the potential for MiC to improve transparency and consistency in permitting decisions may offer ancillary benefits, such as reducing discretionary decision-making and increasing accountability, particularly when paired with digital platforms and open standards.

However, the growing reliance on standardized, offshore-manufactured modules also raises concerns regarding equity, legal responsibility, and urban diversity. Smaller developers or local manufacturers may face barriers to entry if approval systems favor a limited pool of large-scale suppliers, particularly in jurisdictions without clear regulatory pathways for locally-produced MiC elements. Similarly, liability frameworks may need to evolve to address failures in pre-approved systems, especially when designs are reused across multiple projects. From a planning perspective, the proliferation of highly standardized building modules could influence urban form and public perception, potentially diminishing architectural diversity or neighborhood identity. These trade-offs suggest that regulatory innovations must be carefully aligned with broader societal goals, including sustainability, inclusion, and liveability.

The reuse of MiC modules for temporary housing introduces new dimensions to the permitting process, particularly in relation to flexibility, durability standards, and classification of use. Regulatory frameworks traditionally designed for permanent structures may not be well-suited to assess relocatable or short-term dwellings, even if the modules themselves meet structural and safety codes. Permitting authorities may need to consider differentiated approval pathways that account for the unique lifecycle, mobility, and zoning implications of temporary modular housing. Additionally, questions of compliance arise when reused modules are relocated to sites with differing regulatory contexts or climatic conditions, challenging the scalability of type permits across jurisdictions.

This study is limited by its small sample size and geographic focus on Hong Kong. The qualitative nature of the research provides in-depth insights but may not capture the full diversity of perspectives within the construction and regulatory sectors. Additionally, the evolving nature of MiC regulations means that findings may become less relevant as policies and industry practices develop.

Future research should expand to include cross-jurisdictional comparisons of MiC permitting systems, particularly in regions with varying climate conditions and regulatory environments. Quantitative studies assessing the time and cost savings associated with pre-approval systems would provide further evidence to support policy development. Additionally, research on digital permit platforms and the integration of Building Information Modeling (BIM) into MiC approvals could offer pathways to further streamline processes.

6 Conclusions

The objective of this paper was to explore whether Modular Integrated Construction (MiC) can contribute to streamlining the building permit process in Hong Kong. This research addressed the growing need for faster and more efficient permitting procedures in the face of increasing construction demands and the adoption of offsite construction techniques.

Through a qualitative study involving expert interviews and a SWOT analysis, the research identified several key findings. MiC can enhance the permitting process by enabling standardization and pre-approval pathways, such as the In-Principle Approval (IPA) mechanism in Hong Kong. The validation process was grounded in expert input from a diverse group of practitioners, including regulatory officials, project managers, and policy advisors. Their insights confirmed that MiC's potential lies in reducing permit processing times and simplifying regulatory reviews through standardized modules.

The research problem has been addressed by demonstrating that MiC, when supported by regulatory adjustments and pre-approval systems, can streamline the permitting process. The findings align with international experiences, such as the German Typenbaugenehmigung [type permit] system, which underscores the role of standardization in expediting approvals. However, challenges related to interdepartmental coordination, supply chain dependencies, and regulatory adaptation remain critical areas requiring attention.

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Ethical Approval Declaration
The study was conducted in accordance with established standards for research integrity and ethics.

Informed Consent Statement
All participants provided informed consent before participating in the study.

Data Availability Statement
Due to ethical restrictions the data is not published openly but can be requested by the corresponding author.

Conflicts of Interest
The authors declare no conflict of interest.

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